Space Weather Technical Forecast

Issued on Sunday, 05 December 2021 at 12:41 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Active fluence expected from day 2 (6th Dec).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was moderate, with several C-class flares, and one long duration M1 flare peaking at 05/0718 UTC, with all activity likely emanating from AR2898 behind the southwest limb. The start of a CME associated with the M-flare was observed departing to the southwest, updated imagery is awaited for analysis, but this likely to be well off the sun-Earth line. No further Earth-directed CMEs were seen in available imagery. There are currently three sunspot regions visible, with AR2902 (Hrx/Alpha) towards the northwest limb decaying to a simple uni-polar spot. AR2904 (Bxo/Beta) saw some spot development but remained magnetically simple. A new region (Bxo/Beta) appeared in the southwest, likely the re-emergence of AR2903.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1, was indicative of continuing coronal hole high speed stream influences, with speeds of 410-510 km/s, and generally average density values. Total IMF Bt was weak at 1-7 nT, with an unremarkable north-south component Bz of +4 to -5 nT. Phi angle was in a predominantly positive (away from sun) direction. Resultant geomagnetic activity was generally Quiet, with just the one Unsettled interval 04/1800-2100 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) remained at background levels. The high energy electron flux (greater than 2 MeV) was at moderate to high levels, with a peak through the diurnal cycle of 1220 pfu at 04/1850 UTC. The associated 24-hour integrated fluence was below the Active threshold (1e8 integrated pfu), with 4.21e7 integrated pfu detected at 05/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to be low reducing to very low, with a 50% chance of C-class flares and a 10% chance of M-class flares at first from AR2898 behind the southwest limb. The flare risk will reduce by 6th Dec as this region rotates further around the limb.

Solar Wind / Geomagnetic Activity: There are currently no Earth-directed CMEs forecast. A very weak CME from a filament eruption on 3rd Dec may graze Earth on day 3 (7th), but this is low confidence and minimal impacts are expected. Wind speeds are currently slightly elevated, likely due to either CH27/+ or CH28/+ influences, but expected to gradually decline to background levels through days 2 and 3 (6th and 7th). Geomagnetic activity is expected to be mainly Quiet to Unsettled with a chance of isolated Active intervals on days 1-3 (5th-7th), especially if any weak CME influence occurs.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at background levels. The high energy electron flux (greater than 2 MeV) is likely to be a moderate to high levels. The associated 24 hour integrated fluence is likely to

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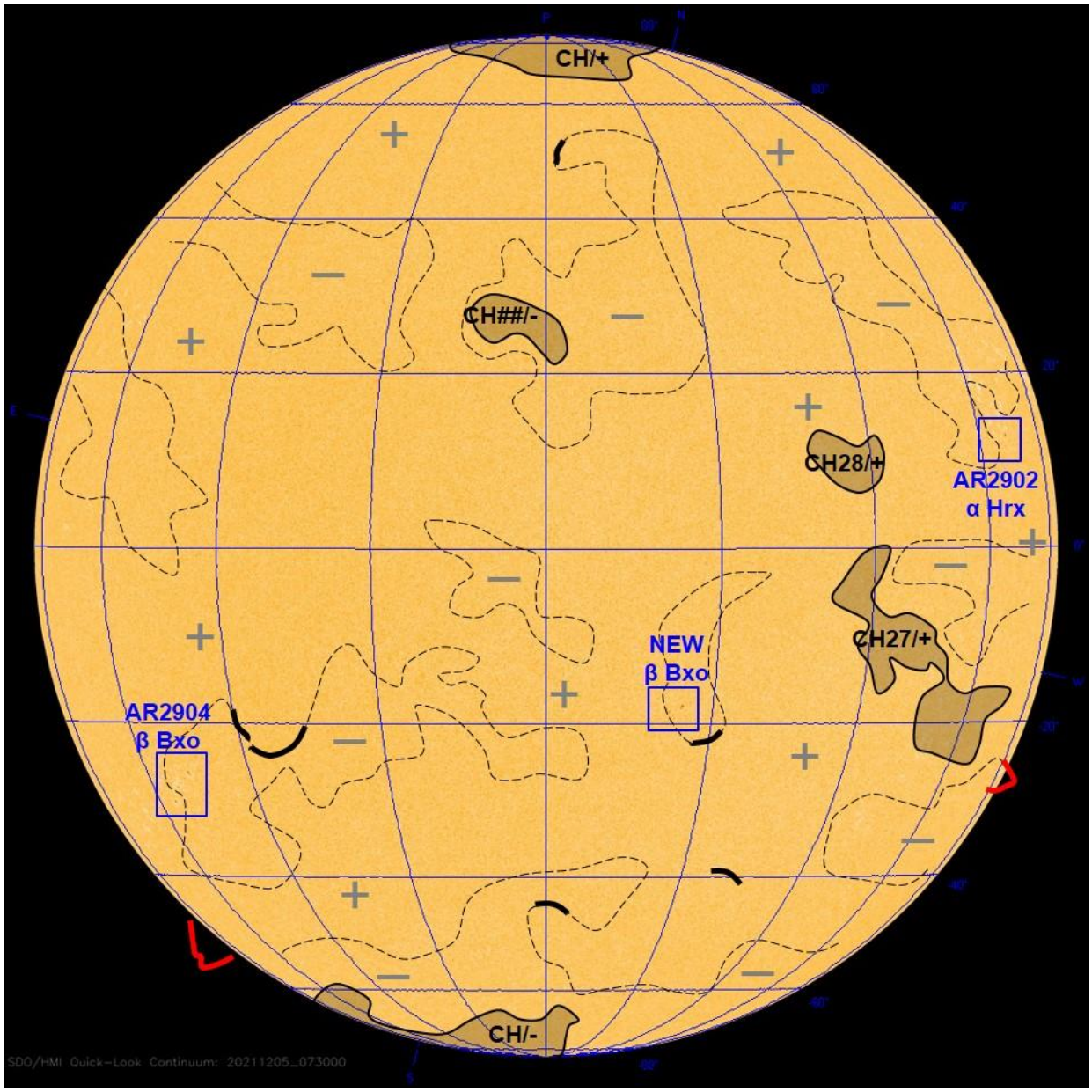
become Active again on day 2 (6th) and remain so through the rest of the period, although confidence is a little low.

Figure 1. Solar Analysis Valid 05/0800 UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are currently no Earth-directed CMEs. A very weak CME from a filament eruption on 3rd Dec may graze Earth on Day 3 (7th Nov), but this is low confidence and minimal impacts are expected.

Wind speeds are currently slightly elevated, likely due to the high speed stream from either CH27/+ or CH28/+. These coronal holes were only present as a weak feature on the last rotation which didn't really connect. Wind speeds are expected to gradually decline to background levels through days 2 and 3 (6th and 7th).

Generally Quiet to Unsettled geomagnetic activity is expected, with a chance of isolated Active intervals on days 1-3 (5th-7th), especially if any weak CME influence occurs.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	5	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Figure 2: Past 24 hours solar wind data from DSCOVR at L1, showing slightly elevated speeds continuing (yellow trace)

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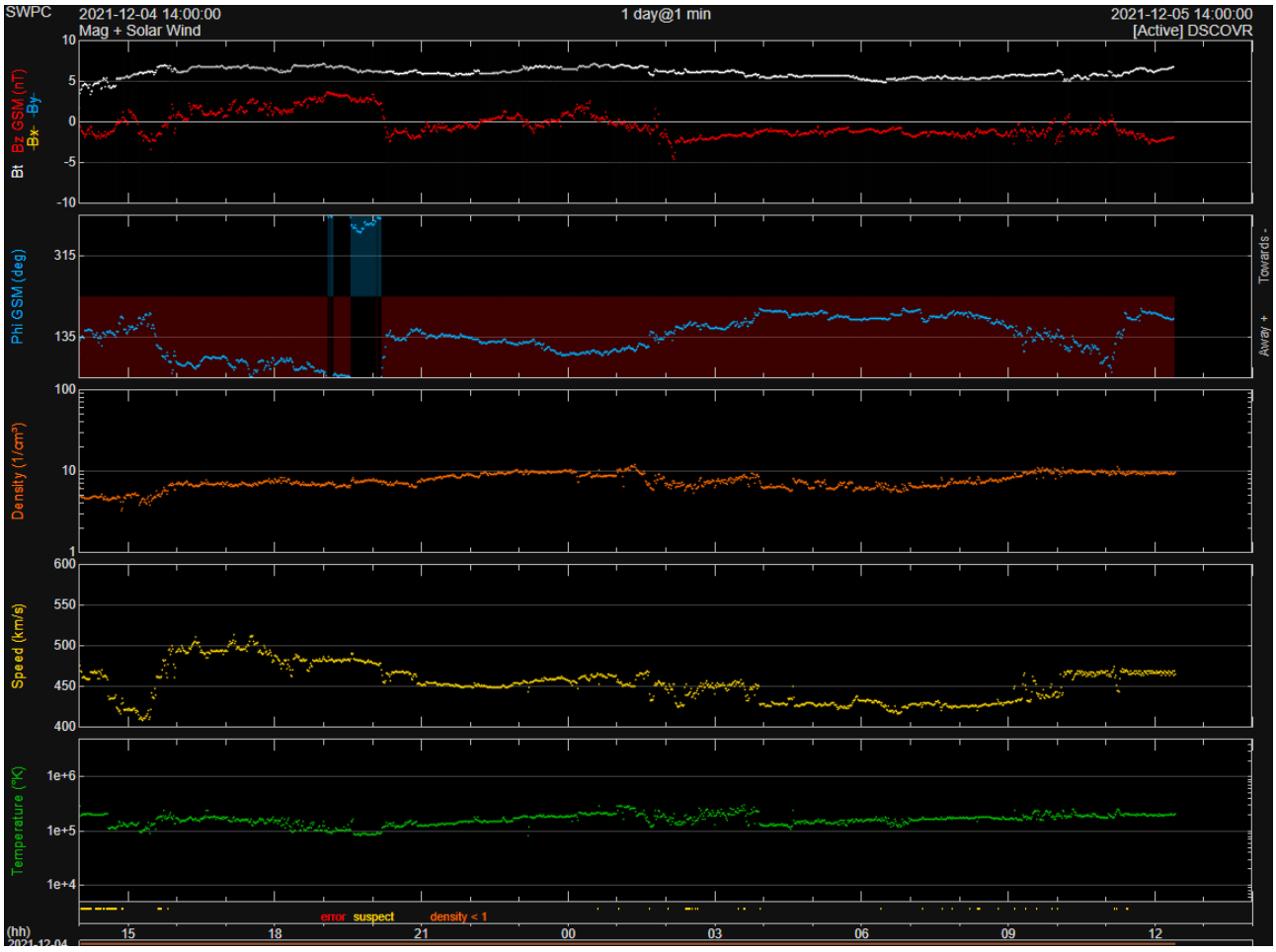

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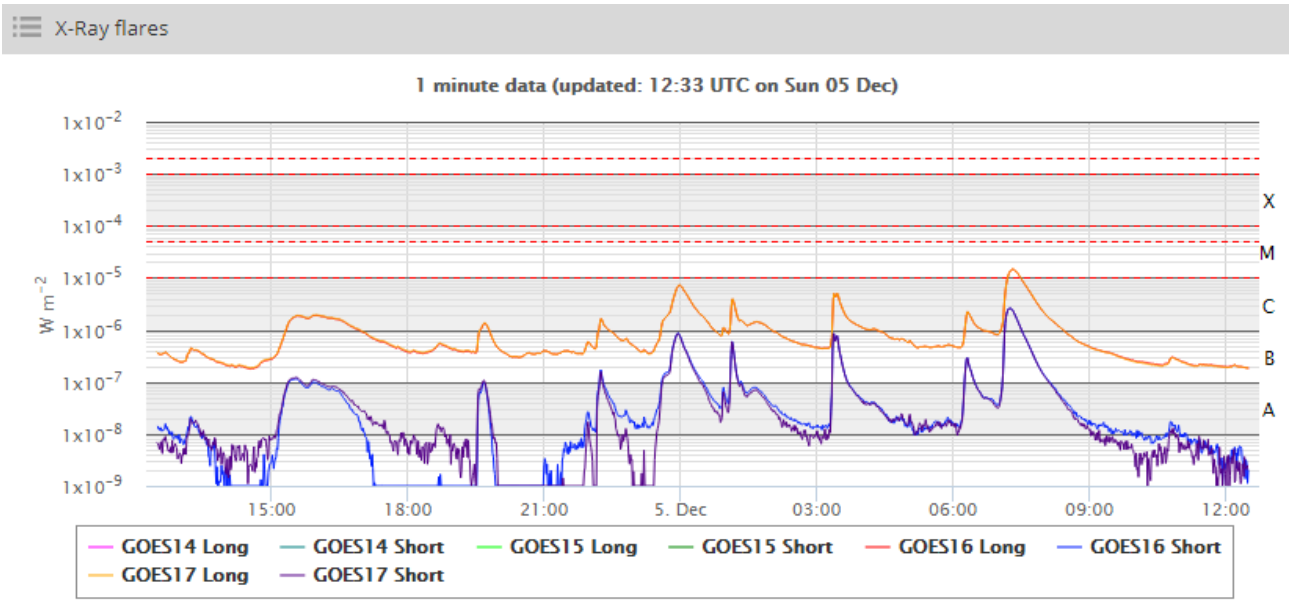
Radio Blackouts - X-Ray Flares:

AR2898 beyond the southwest limb has generated several C-class and one long duration M1 flare over the past 24 hours. A likelihood of C-class activity and 10% chance of further M-class flares is maintained for the rest of day 1 as the region moves further into the far side. Otherwise, very low solar activity is expected through the rest of the period, with currently just three small and magnetically very simple sunspot regions on the visible disc.

Current STEREO A EUVI imagery would suggest no further significant regions likely to move into view through the next four days.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	10	2	1	1
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: Past 24 hours X-Ray flux at GEO



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES-16 is forecast to remain at background levels, with no solar radiation storms anticipated.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2 MeV) as observed by GOES-16 is showing signs of a recovery after declining through much of 4th Dec. Solar winds remain slightly elevated, and only a slow return to background speeds is expected through 7th-8th. Generally moderate to high flux values are anticipated through the forecast period.

The associated 24 hour electron fluence is now showing a slight rising trend, and currently likely to rise above the Active (greater than 1e8 integrated pfu) threshold on day 2 (6th) then probably remaining above through days 3 and 4 (7th and 8th). REFM is suggesting a downward trend but considered in error due to more extensive coronal holes in the west on this rotation.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ 2 MeV ≥ $1x10^8$	No	20	60	50	40
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	5	5	1

Figure 4: Latest MOSWOC REFM data

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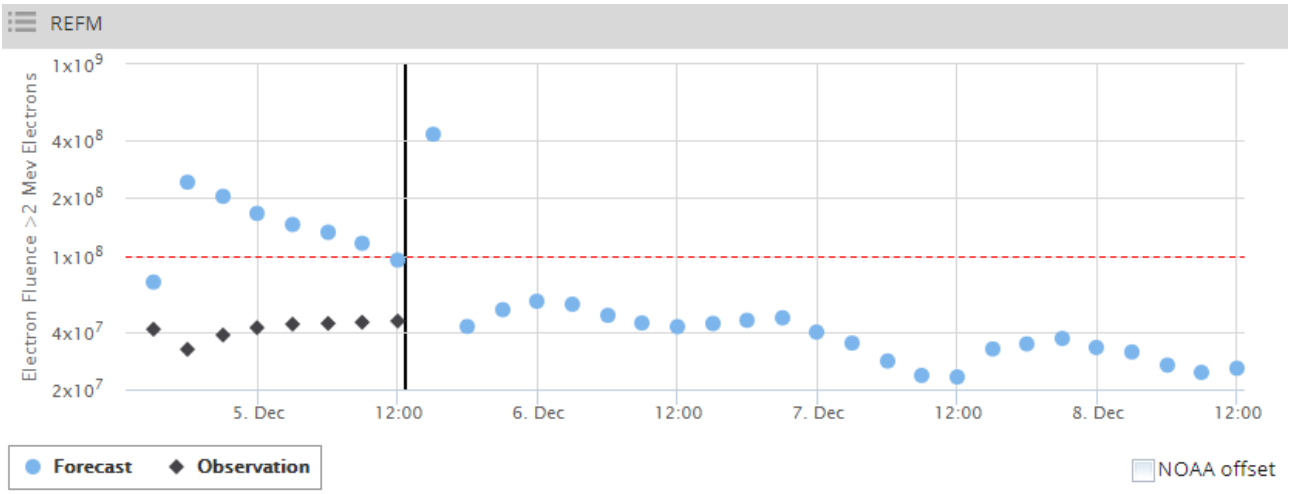

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